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NEUROIS: CHALLENGES AND SOLUTIONS

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NEUROIS: CHALLENGES AND SOLUTIONS

Panels

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Abstract

Consistent with the ICIS conference theme "Gateway to the Future," this panel will debate the advantages of pursuing NeuroIS – an emerging area in the IS discipline that offers a new lens into IS phenomena by looking into the brain's functionality – relative to the challenges inherent in adopting a new set of neuroscience theories and tools .

The panelists will debate whether the difficulties involved in conducting NeuroIS studies outweigh their benefits, and whether it is possible to overcome these challenges. Izak Benbasat will outline the process of conducting NeuroIS studies, including identifying interesting IS research problems, designing experiments, and presenting results. Kai Lim and Eric Walden will focus on the challenges of NeuroIS studies, while Angelika Dimoka will seek to counteract these challenges with a set of solutions. From an editor's perspective, Detmar Straub will discuss the challenges in editing and reviewing manuscripts that rely on novel (neuroscience) theories and (neurophysiological) tools, offering guidelines for authors for publishing in this new area.

The panel seeks to have a broad appeal to IS researchers who may be interested in NeuroIS but may be impeded by its challenges. The panel's ultimate goal is to assess if these challenges could be overcome and give IS researchers a set of actionable solutions to conduct high-quality studies.

Keywords: NeuroIS, Neuroscience, Functional Neuroimaging, Brain Imaging Tools.

Panel Motivation

Last year's ICIS panel on "NeuroIS: Hype or Hope" (Dimoka, Bagozzi, Banker, Brynjolfsson, Davis, Gupta and Riedl, 2009), which drew a stand-in only crowd of about 200 attendees, concluded that many interesting insights could emerge from delving into the brain's functionality to inform IS phenomena. In fact, there is much interest among IS researchers in exploring the potential of NeuroIS, and several studies with neuroimaging and physiological results have appeared in prominent IS journals and conferences (e.g., Cyr et al., 2009; Dimoka, 2010a; Dimoka et al., 2010a; Dimoka and Davis, 2008; Galletta et al., 2007; Moore et al., 2005; Randolph et al., 2006; Riedl et al., 2010). However, the panelists also raised several concerns about the broad applicability of NeuroIS in the IS community given challenges with the use of the neuroscience literature as a reference discipline and practical difficulties associated with the use of physiological and neuroimaging tools (Dimoka et al., 2010b). These challenges need to be acknowledged, and the purpose of this panel is to identify, debate, and attempt to overcome these challenges to help IS researchers to harness the potential of NeuroIS as a 'Gateway to the Future'.

Panel Description

The panelists will draw from their own experiences with NeuroIS studies to reflect upon the difficulties they have encountered when designing, executing, presenting, and publishing or editing NeuroIS studies. Starting with the panel's motivation, Izak Benbasat will give a brief overview of the current state of NeuroIS, and then elaborate on the process by which a typical NeuroIS study can be conducted. This will serve as the basis for the other panelists to debate the trade-off between challenges and solutions when pursuing NeuroIS. Focusing on the challenges of NeuroIS, Kai Lim and Eric Walden will each discuss their own experiences from being involved in NeuroIS studies, focusing on the challenges they have encountered. In contrast, Angelika Dimoka will attempt to counteract these arguments by offering specific guidelines and suggestions to overcome the challenges faced by IS researchers when conducting NeuroIS studies. Dimoka will conclude that despite these challenges, it is feasible for IS researchers to rely on the neuroscience literature and conduct neuroimaging studies. Finally, from an editor's perspective, Detmar Straub will discuss the challenges in reviewing manuscripts that rely on novel (neuroscience) theories and (neurophysiological) tools, focusing on how to select knowledgeable reviewers in a still growing IS community and offering guidelines for IS researchers who want to publish NeuroIS studies.

Outlining the Process of Conducting NeuroIS Studies

To provide a basis for the panelists to debate the challenges and opportunities of NeuroIS, Izak Benbasat will outline the basic steps in the process of conducting a NeuroIS study based on his perspective as an experienced laboratory experimenter, but a novice NeuroIS researcher, that fits the profile of many of the attendees. Benbasat will note that the first step involved in NeuroIS studies is to become familiar with the neuroscience literature that pertains to the relevant context of the research. The neuroscience literature is building a rich knowledge base on how people make decisions (Camerer, Loewenstein and Prelec, 2005), manage risk, and uncertainty (Glimcher and Rustichini, 2004), respond to rewards and penalties (Krain et al., 2006), trust and distrust (Dimoka, 2010a), and predict the behavior of others (McCabe et al., 2001). Accordingly, Benbasat will briefly overview some of the neuroscience literature.

Benbasat will outline that the next step is to propose interesting and meaningful research questions that can both benefit from and also can be conducted with neuroimaging tools. He will outline some of the advantages of these tools in terms of giving data drawn directly from the human body and capturing data that may not be easily self-reported because of social desirability bias and political correctness. Drawing from his study of evaluating avatar designs, he will discuss the motivation of the fMRI study, focusing on the early stages of designing the fMRI study and the challenges faced from the perspective of a novice NeuroIS researcher when designing and adapting the behavioral experiment to the fMRI context. This study was earlier conducted with a traditional laboratory experiment using standard data collection instruments; so why fMRI? Benbasat will explain that the goal of NeuroIS studies is to render novel empirical data that cannot be inferred otherwise by existing methods that may be more accessible and mainstream to IS researchers.

Third, in terms of obtaining access to the appropriate (physiological or neuroimaging) tools, Benbasat will briefly mention a set of commonly-used neurophysiological tools (Dimoka et al., 2010b), and will discuss his experience in obtaining access to appropriate fMRI facilities by collaborating with neuroscientists. Fourth, in terms of conducting neurophysiological studies and analyzing corresponding human and brain data, Benbasat will focus on the

challenges he faced when attempting to draw inferences from neuroimaging results, and particularly how to integrate traditional behavioral data with fMRI data. Finally, Benbasat will discuss the process of reporting neurophysiological results for publication in IS journals.

Challenges in Engaging in NeuroIS studies

Kai Lim will argue that engaging in NeuroIS studies is not trivial. He will outline many of the challenges he personally faced when conducting the basic steps that Benbasat outlined earlier. First, Lim will argue that becoming familiar with the vast neuroscience is not a trivial task. Besides the difficulty in understanding a rather distant literature, the neuroscience literature that focuses on neuroimaging and physiological data is rapidly expanding, and it is not particularly easy to catch up. While fMRI is the most common method, studies with physiological (e.g., eye tracking, electrocardiogram) or other brain imaging tools (e.g., EEG, MEG) are also abundant in the literature. While this gives abundant richness to the neuroscience literature, it is undeniably challenging for IS researchers to stay on top of this rapidly expanding literature.

Lim will also discuss the challenges in identifying interesting IS research problems that can be enhanced with neuroimaging or physiological data. While arguably any new source of data is useful, identifying exciting research problems that neuroimaging data can help inform IS phenomena in truly novel ways is not a trivial task, and there is a steep learning curve in integrating existing IS research questions with neuroimaging or physiological data to propose meaningful research questions. Therefore, although identifying interesting IS research question is difficult, identifying interesting IS research questions that can be informed by NeuroIS data is even more challenging.

Third, Lim will discuss the challenges in using neuroimaging tools, including cost and accessibility. These tools reside in specialized facilities that are not widely accessible to IS researchers, such as imaging centers or experimental labs. Getting access to these tools is costly and requires collaborations with researchers in other departments and schools. Moreover, Lim will discuss some of the challenges he faced when designing neuroimaging studies, explaining that learning to conduct neuroimaging studies, is not trivial. Finally, Lim will argue that NeuroIS is not mainstream MIS and it might require a lot of effort and specialized knowledge to address the idiosyncrasies of the constrained fMRI environment, and it has a steep learning curve that requires a substantial time commitment.

Challenges in Analyzing and Presenting NeuroIS Data

Based on his own experiences in conducting NeuroIS studies, Eric Walden will focus on the challenges in analyzing and presenting NeuroIS studies. Walden will discuss the challenges to analyze and present NeuroIS data. First, NeuroIS (using fMRI) deals with three dimensional pictures of human brains plus a fourth time dimension. Each individual brain image can contain upwards of 50,000 voxels (a three dimensional pixel), and a full brain image can be captured every two seconds, thus even a short, 10 minute, experiment can generate 15 *million* or more observations. Moreover, these observations may be correlate across space and time, making the analysis non-trivial.

Furthermore, because brains, like all body parts vary in shapes across individuals, brain images must be mapped into a standard brain shape for comparison. This is a complicated procedure that deforms the actual brain images until they fit a standard brain. Also, because subject movement at some point in space will contain different areas of the brain over time, algorithms must be deployed to correct for movement, and then each full brain image must be mapped into the same space.

Finally, time series analysis must be applied to each voxel to check for significant differences in activation, however, with 50,000 voxels type I error is a major issue. Therefore, corrections must be made for false positives and clusters of activation must be discovered. Because this is a very specific and complex process, specialized software must be used. Walden will discuss some of the software tools available to analyze fMRI images.

Solutions and Remedies in Conducting NeuroIS Studies

In contrast, Angelika Dimoka will argue that the potential and opportunities of NeuroIS outweigh these challenges, offering a set of solutions and remedies to overcome these challenges. First, Dimoka will explain that there are corresponding applications of neuroscience to related fields, such as economics, psychology, and marketing. She will provide examples of how to conduct a focused literature review of the neuroscience literature pertaining to her research, such as trust and distrust (Dimoka, 2010a) and technology adoption and use (Dimoka et al., 2010a).

Dimoka will also discuss what factors make the choice of fMRI technique particularly beneficial in IS studies, and how it is possible to tackle research questions that could not be answered with existing methods. For example, merely identifying the neural correlates of IS constructs can be extremely useful in better understanding the nature and dimensionality of IS constructs, offering examples from her current studies (Dimoka 2010, Dimoka and Davis, 2008). Using fMRI data, it is possible to identify "hidden" processes that people are unable, unwilling, or uncomfortable to self-report. Dimoka will offer guidelines on how to use stimuli that closely correspond to those used in traditional behavioral studies, such as psychometric measurement items to induce brain activation for specific IS constructs (Dimoka, 2010b). Moreover, she will provide an overview on how to obtain relevant knowledge about neurophysiological tools through specialized workshops and other learning forums.

In terms of data analysis, Dimoka will discuss the tools available to analyze brain data. Thus, despite the challenges associated with the analysis of large-scale brain data, there are sophisticated data analysis tools that can be readily used to account for the idiosyncrasies of brain data. Finally, Dimoka will report on her experiences in reporting neuroimaging results in IS conferences and IS journals, concluding that the novel approach rendered by NeuroIS studies make it possible to propose some exciting new findings that can inform IS research.

Challenges & Solutions in Editing and Publishing NeuroIS Manuscripts

Taking the debate to the domain of editing and publishing NeuroIS papers, Detmar Straub will discuss both the challenges and also potential solutions in editing and publishing NeuroIS manuscripts. As with any new method, there are several challenges in submitting and reviewing articles that use a rather novel methodology and require expertise from many different disciplines.

From an editor's perspective, Straub will discuss the challenge of identifying reviewers that have the expertise to evaluate the study. There may be expertise available for the methodology itself, but it may not overlap with the needed expertise of the discipline to which it is being applied. There are undoubtedly neuroscientists who could evaluate the technical discussion of the empirical evidence, but they would not as likely have the tacit knowledge of the standards of the journal, the standards of the field, and the level of contribution that is required. It is possible, however, for a good editor to weight the methodological form of evaluation and combine it with other forms that would focus on the substantive arguments. It is not uncommon on review teams, for example, to pair a domain expert with a statistical methods expert, since these are not always co-existential. It works especially well if the editor prepares the groundwork by indicating what kind and level of review she would like from individual reviewers. In other words, the editor can make reassuring statements to one set of reviewers that they need not focus heavily on the methods since there is an expert on the review team. And to the other set of reviewers that they need not focus on the content and theory development as much as data analysis. Reviewers always seem to be willing to have their jobs scoped out for them in this fashion.

Finally, Straub will offer guidelines to authors who wish to publish NeuroIS studies in prominent IS journals, including specifying interesting research questions that cannot be easily inferred with existing research methods, clearly explaining any technical material in clearly understood layman terms, trying to integrate new sources of data with existing ones to show how they complement each other, and suggesting knowledgeable reviewers who have different types of expertise needed to evaluate such inter-disciplinary manuscripts.

Panel Discussion

The panelists will initially have 6 minutes each to present their arguments, totaling 30 minutes. After the individual panel presentations that will give a basis for a discussion among the panelists and the audience, the panelists will seek to engage the audience in a discussion around the challenges of conducting NeuroIS studies and their suggested solutions and best practices for overcoming these challenges. This 60-minute discussion among the panelists and the audience will focus on five key questions. How can we identify interesting IS research problems that can be informed by NeuroIS? How can we conduct high-quality NeuroIS studies? How can we analyze and present NeuroIS data? How can we publish NeuroIS studies in IS journals? What is the potential of NeuroIS as a 'Gateway to the Future'? The panel discussions may also include questions from the audience and a broader discussion led by the audience on NeuroIS issues not necessarily within the domain of the panelists' initial presentations.

The panel with the help of the audience will engage in an active debate on the challenges of conducting NeuroIS studies and how to overcome these challenges. The purpose of this general discussion, which will also include

questions and discussion on topics brought by the audience, is to collect a set of guidelines and best practices for overcoming the identified challenges of NeuroIS.

Panel Deliverables

The panel will have a broad appeal to IS researchers who are interested in NeuroIS but may be constrained by the challenges associated with learning the neuroscience literature and employing physiological or neuroimaging tools. The panel's ultimate goal is to overcome the challenges and roadblocks associated with NeuroIS research and give IS researchers a set of actionable guidelines and best practices to conduct high-quality NeuroIS studies. The ultimate deliverable is to help define a NeuroIS research program as a 'Gateway for the Future' that includes identifying interesting IS research problems, conducting high-quality NeuroIS studies, analyzing neuroimaging data and presenting results, and publishing NeuroIS papers in prominent IS journals.

All participants have made a commitment to attend the conference and serve on the panel.

References available upon request.

Bios

Izak Benbasat is a Fellow of the Royal Society of Canada and CANADA Research Chair in Information Technology Management at the Sauder School of Business, University of British Columbia, Canada. He currently serves on the editorial boards of Journal Management Information Systems and Information Systems Journal. He was editor-in-chief of Information Systems Research, editor of the Information Systems and Decision Support Systems Department of Management Science, and a senior editor of MIS Quarterly. He became a Fellow of the Association for Information Systems in 2002 and received the Leo Award for Lifetime Exceptional Achievements in Information Systems from the Association for Information Systems in 2007.

Angelika Dimoka is an Assistant Professor in Management Information Systems and Marketing at Temple University. She also has a joint appointment in the College of Engineering. Dr. Dimoka is the director for the Center of Neural Decision Making, Temple University. Dr. Dimoka received her PhD from the University of Southern California. Her current research interests lie on cognitive neuroscience and functional brain imaging in social sciences and especially in information systems and marketing. Dr. Dimoka's research has appeared in the Information Systems Research, MIS Quarterly, NeuroImage, Neuroscience Methods, IEEE Transactions in Biomedical Engineering, Annals of Biomedical Engineering, IEEE in Biology and Medicine.

Kai Lim is a Professor of Information Systems at City University of Hong Kong. He is currently serving or has served on the Editorial Boards of MIS Quarterly, Information Systems Research, and The Journal of the Association for Information Systems. He received his Ph.D. from the University of British Columbia, Canada. His research centered on the behavioral and managerial aspects of Information Systems. Currently, he is studying eCommerce-related adoption issues, human-computer interactions, knowledge management, and cross-cultural issues related to information systems management. His work has appeared in some of the most prestige IS journals, including Information Systems Research, Journal of Management Information Systems, and MIS Quarterly.

Detmar Straub is the J. Mack Robinson Distinguished Professor of Information Systems at Georgia State University. He holds a DBA in MIS from Indiana and a PhD in English from Penn State. He has conducted research in the areas of computer security, Net-enhanced organizations (e-Commerce), technological innovation, IS research methods, and international IT studies. Detmar has more than 160 publications in journals such as MIS Quarterly, Management Science, Information Systems Research, Journal of MIS, and many others. Dr. Straub is Editor-in-Chief of MIS Quarterly (term runs to December 2011). Former VP of Publications for AIS, he has held roles as co-program chair for AMCIS and ICIS and was inducted as an AIS fellow in 2005.

Eric Walden is the Wetherbe professor of Information Systems at the Rawls College of Business at Texas Tech University. His research interests focus on developing a greater understanding of information systems in the organizational context. This includes issues within and among organizations. Eric tries to combine strong theory from industrial organization in economics, with empirical validation within an organizational context. Eric received his Ph.D. from The University of Minnesota. He is the Cofounder and CEO of the social networking site letslivegreener.com. His prior research has appeared in *Information Systems Research*, *MIS Quarterly*, *Harvard Business Review*, *The International Journal of Electronic Commerce*, and *Electronic Markets*.